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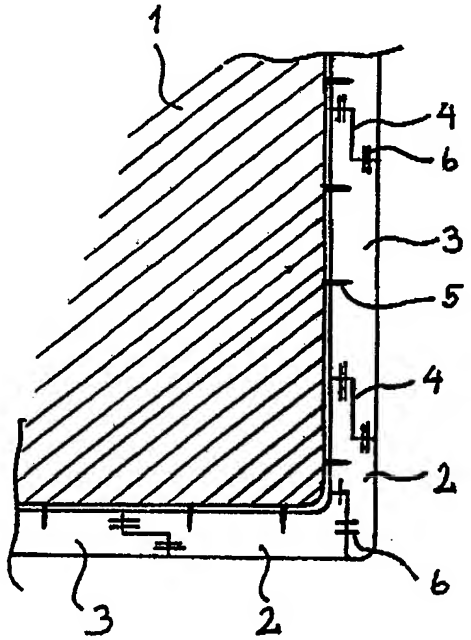

(57) Abstract

For fire protection of constructions (1) of metal and composites, where the construction may have an uneven shape, mats (2, 3) are used which are connected to the construction by means of pins (5) or similar devices. The mats are divided into sections (2, 3) which are preferably laid overlapping one another and are made of intumescent and possibly ceramic-forming materials. The sections are glued to the surface of the construction (1) by a paste with the same properties as the mat material.

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Method for fire protection of constructions and a fire protection mat

The invention concerns a fire protective mat designed for use in connection with constructions of metal and composites.

To date a variety of methods have been used for the protection of constructions of metal or composites against fire, but none of these has proved satisfactory in practice. Constructions of the type which require protection are, e.g. steel constructions on offshore installations, where safeguards are required against the construction being affected by excess heat, thus allowing a fire to spread, or elements within the construction being destroyed by heat stress, e.g. the collapse of load-bearing constructions. The methods employed to date have mainly concentrated on the application of fire protection, intumescent coatings in the form of a liquid or paste which is preferably applied by spraying. Use has also been made of flexible mats consisting of ceramic, fireproof fibres or similar materials, which have been fitted around the construction.

Applications of coating in the form of a liquid or paste may appear to be advantageous when coating uneven surfaces, but this method has also proved to have serious disadvantages. One major disadvantage is that a spray application of this kind will be time consuming since several coats have to be applied which have to harden separately, the surface has to be treated in order to achieve binding to the next coat, etc. The application of a coating either in paste or liquid form can also be a messy business and unpleasant for personnel. Another major disadvantage of the application of these coatings is that there is no guarantee of an even thickness, which can soon result in weak areas of which one is unaware. This type of intumescent coating can also loosen when exposed to intense heat, leading to a great deal of extra work with the installation of reinforcements, etc. The required coating thickness is in the area of 5-30 mm.

Flexible mats based on ceramic fibre have the advantage that they are easier to apply, but have the disadvantage that they do not give such good protection and will occupy substantially more space. Another disadvantage is that weak points can easily arise in the joints between the mats, and there is also a problem with attachment. These mats can be prefabricated in sheet form and attached to the object which is to be protected with nails, bolts, etc.

For offshore use there are special requirements regarding materials and performance. The following functions amongst others require to be fulfilled:

- The coating should give fire protection for at least 2 hours at approx. 1100 degrees C.
- The coating should give corrosion protection of the steel or base layer.
- The coating should be easy to instal.
- The coating should be mechanically strong.

In the prior art, steel pins have been welded to the part which has to be protected, which is usually made of steel, whereupon a priming coat has been sprayed on. On to this coat part of the fire protection coating is then sprayed, e.g. in a 2mm thick coat, after which a reinforcing net of steel is applied which is curved around the welded pins, and the whole construction is then coated by means of a spraying technique to achieve a coating of full thickness.

Due to the requirement that the pre-welded pins and reinforcement should be placed inside the material, together with the fact that the epoxy-based coating is suitable for spraying, until now the above-described method of applying the coating has been chosen. The requirement that the base layer of steel should not run the risk of being damaged, which can lead to mechanical failure, rules out the use of bolts, screws, etc.

The disadvantage with the technique in question is that the spraying work is environmentally difficult to implement in addition to being time consuming and it is difficult to check the quality of the resultant coating, particularly in corners and flanges.

The object of the present invention is to provide a fire protective mat in which the advantages of the intumescent, sprayable or applicable coating can be combined with the good qualities of a mat material. In addition the coating should also have a corrosion protective effect.

A further object of the invention is to provide a mat which thus has both intumescent qualities and some degree of flexibility, thus allowing the mat to be shaped to a certain extent according to the surface of the construction, thereby assuming both a convex and a concave shape.

Yet another object of the invention is to provide a mat which can be attached to the construction in a relatively simple manner, and where the mat sections can be joined together in such a way that no splits or openings occur, thus giving a smooth, uniform quality to the whole protective system.

These objects are achieved with a fire protective mat which is characterized by the claims presented.

By means of the invention a number of the disadvantages of the previously used technique are avoided. From the environmental point of view spray coating can be completely or largely eliminated by using instead sheets and profiles together with a joining technique using the same material in the form of a paste. The prefabricated parts with embedded reinforcement are hung/attached to the welded pins. The side facing the steel can be shaped so that an even distribution of the adhesive material is achieved, thus obtaining an even and correct mass distribution from the fire technical point of view. There is an additional guarantee that the quality requirements are

fulfilled at critical points such as corners and flanges, despite the fact that the installation work is simplified in the form of shorter installation time and greater safety.

The mat in accordance with the present invention is based on the use of intumescent materials which form a ceramic when exposed to fire, and are based on a basic mass of hardened plastic, e.g. epoxy, polyester or acrylate plastic which are combined with a filling medium which has intumescent and possibly also ceramic-forming properties. Such a mat can be produced in thicknesses of up to at least 10 mm and will have a relatively high degree of flexibility. In order to give the mat sufficient mechanical strength in case of fire, it is reinforced with glass fibre or metal, preferably in the form of a mesh. In the case of steel constructions, e.g., it can be advantageous to use a steel netting as reinforcement. The mat can have a production width of 1 m and a density of between 0.7 and 1.3 g pr. cubic cm. To surround complicated constructions, mats of various widths can be designed, thus making it easier to adapt them to the shape. For corners mat sections can be designed of an angular shape. Alternatively, the mats could be joined in the corner. For joining purposes the mats can be equipped with a bevel or stepped edge, thus allowing the mat elements to be fitted overlapping one another in order to maintain the total thickness. As a means of connection for joining the elements together, a paste is used which can be ironed or sprayed on to form a completely airtight connection. This paste consists of a material with properties of the same kind as the composition of the mat. By laying mats in the described manner, an extremely even and dense quality will be achieved for the intumescent, fire protection coating, and it will be possible to obtain a required thickness which is constant over the whole area with the use of the mat, since this thickness can be doubled by fitting several mats on top of one another. The spaces between the mats which will be filled with paste can be relatively wide.

In the method according to the invention, the mats are attached by means of attaching members such as pins, which in the case of steel constructions can be welded on to the surface and in the case of composites are attached with special screws. These pins or attaching members will stick into the mat and secure it in the event of ceramicisation during a fire and ensure that the fire protection remains in place. This is important, since the mat will lose some of its strength during intumescence and pyrolysis. This effect is also counteracted by the embedded reinforcement.

In one embodiment of the invention the material is primed or painted with a thin, corrosion protective coating. In or on this coat of paint a thin layer of hardening glue is sprayed which serves to attach the mat to the base. When thin mat coatings 5-10 mm in thickness are used, the mat can be installed with the mats laid edge to edge. A bevelling or stepped edge of the mats is provided by having the mat's reinforcement mesh stick out at each side. This reinforcement is laid so that it is overlapping. Paste with the same composition as the mat material is inserted into the joints, thus giving a homogeneous mass when it hardens. This paste will also penetrate into the reinforcement mesh and form a uniform mat structure from the individual mat sections.

Thicker layers up to 30 mm are provided by applying several layers of mats with a standardised thickness, e.g. 5 mm. The mats are glued on to one another and laid edge to edge with a jointing tape. The next layer is applied overlapping the last. The mat is attached mechanically only partly by gluing, since due to heating it will also be necessary to attach the mats with spikes or pins which are attached to the construction. When the material swells the spikes will be incapsulated and the mat structure secured. The reinforcement in the actual mat will make the mat structure self-supporting.

In a second embodiment the basis is a similar preparatory treatment of the steel surface to that in the first example and

the use of hardening glue. In this case mats are used with different widths, e.g. strips with a width of 10-30 mm, angle elements for corners, e.g. 40x40 mm in dimension, and wider mats with a width of between 300 and 600 mm. The insulation is built up by gluing the angles at the corners of the steel and lining the sides with mats. The narrow strips are used on surfaces which are extremely curved. The pins or pegs which are attached to the steel construction by welding are best positioned so that they fit into the joints. The joints are filled with paste by means of a joint spray. The mat's reinforcement can be mounted in two ways. It can be incorporated in the mat during production. These are supplied preferably with a projecting reinforcement edge for overlapping at the joints. This is difficult for angles and corners where unreinforced profiles will have to be used which are lined with reinforcement on the spot and covered with paste. The other alternative is to use unreinforced strips, mats, angles, etc. and then line these with reinforcement which is attached to the pins. The joints are filled with a joint spray and the whole structure covered with a coat of paste.

The third alternative is illustrated schematically in the figure. One corner of the iron construction 1 is represented schematically with hatching. Around one corner mats have been installed in accordance with the invention. At the corner of the construction 1 is installed an angular mat element 2, which is followed on both sides by standard mat element 3. All mat elements 2 and 3 have stepped side edges, as illustrated by 4. At these stepped areas the mats have been laid overlapping and secured by means of a paste with the same composition as the material of the mat. The mat is glued to the construction 1 by means of a hardening agent and further attached by means of pins 5 which are welded on steel. The pins are preferably also placed in the joint area. The mat is further equipped with a reinforcement in the form of a glass fibre mesh 6 which is lying loose in the step joint area. When exposed to fire the mat will swell and thus become attached to the pins 5. A mat

protection constructed as illustrated in the figure will give an even and reliable protection of the construction.

The advantages achieved by the method and the mat in accordance with the invention can be summarized as follows:

- shorter application time
- more reliable dimensioning of the coating
- more reliable positioning of reinforcement
- less mess
- lower total costs

Many modifications will be possible within the scope of the invention. Thus as described various types of reinforcement, both glass fibre and metal, can be used, and various types of hardening plaster, both of the epoxy, polyester, phenol and acrylate type. The joint at the side edges can be made by laying the edges against one another and "gluing" the edges with paste, even though overlapping will give the best transition.

PATENT CLAIMS

1. A method for fire protection of constructions etc. by the use of mats,
characterized in that on its surface the construction is equipped with attaching members such as pins, e.g. by welding, which members protrude from the surface of the construction, that on to these devices are attached or hooked intumescent, flexible mat sections of hardened plastic to which is added intumescent and possibly ceramic-forming materials, which mat sections are in addition glued to the surface of the construction,
and that the mat sections are laid overlapping or abutting together and joined together by the application of a paste with the same properties as the composition of the mat.

2. A method according to claim 1,
characterized in that mats are used of different widths and possibly of an angular shape.

3. A fire protective mat for use in connection with constructions of metal or composites,
characterized in that it is based on a base mass of hardened plastic to which is added intumescent and possibly ceramic-forming materials,
that the mat is further reinforced with glass fibre, preferably a glass fibre mesh, possibly a metal, e.g. steel netting,
and that in its edge areas the mat is equipped with bevelling, tracks, protruding reinforcement or similar means for overlapping or abutment of several mats.

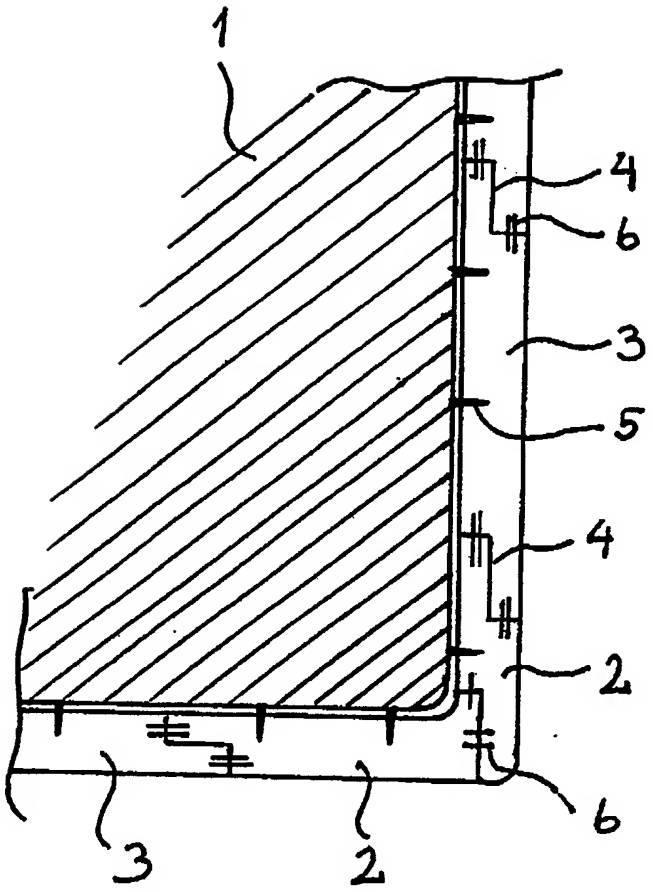
4. A mat according to claim 3,
characterized in that it has an angular shape.

5. A mat according to claim 3,
characterized in that the hardening plastic is an epoxy, polyester, phenol or acrylate plastic.

6. A mat according to claim 3, characterized in that the filling medium contains aluminium compound, silicium compound, possibly also calcium compound together with an additive of alkalimetal compounds.

7. A mat according to claim 3, characterized in that it can be rolled up.

8. A mat according to claim 3, characterized in that the overlap areas along the side are composed exclusively of the mat's reinforcing material.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INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 91/00075

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: E 04 B 1/94 // E 04 B 101:00

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	E 04 B; B 32 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

FI,NO classes as above

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